

CLAIMS

1           A switch element comprising:  
2           a plurality of input interfaces to receive data;  
3           a plurality of output interfaces to transmit said data; and  
4           a buffer to couple to said plurality of input interfaces and to said plurality of  
5           output interfaces, the buffer including a multi-dimensional array of output queues to  
6           store said data, wherein said multi-dimensional array of output queues is shared by said  
7           plurality of output interfaces.

1           2. The switch element of claim 1, wherein said multi-dimensional array of  
2           output queues comprise a three-dimensional array of output queues.

1           Sub. A      The switch element of claim 2, wherein said three-dimensions comprise:  
2           a)        a first dimension relating to a number of outputs on said switch  
3           element;  
4           b)        a second dimension relating to a number of logical paths for said data;  
5           and  
6           c)        a third dimension relating to a number of outputs from a next switch  
7           element.

1           4. The switch element of claim 3, wherein said logical paths are assigned  
2           priority levels.

1           5. The switch element of claim 1, wherein said multi-dimensional array of  
2           output queues share space of said buffer.

1           6. The switch element of claim 1, further comprising a plurality of virtual  
2           input queues, wherein each virtual input queue represents a portion of said buffer.

1           7. The switch element of claim 1, further comprising an arbiter to select  
2           data for transmission of said data to a downstream element.

1           8. The switch element of claim 7, wherein said arbiter selects said data  
2           based on status information at said switch element.

1           Sub A      The switch element of claim 8, wherein a queue status monitor  
2           transmits a feedback signal from said switch element to a plurality of upstream switch  
3           elements, said feedback signal comprising status information of output queues of said  
4           switch element.

1           10. The switch element of claim 8, wherein said arbiter selects said data by  
2           utilizing transmit pressure information.

1           **11.** A switch fabric network for transmitting data, said network comprising:  
2            a first switch element; and  
3            a second switch element coupled to said first switch element, said second  
4            switch element comprising:  
5                a plurality of input interfaces to receive data from at least said first  
6            switch element;  
7                a plurality of output interfaces to transmit said data; and  
8                a buffer to couple to said plurality of input interfaces and to said  
9            plurality of output interfaces, the buffer including a multi-dimensional array of output  
10           queues to store said data, wherein said multi-dimensional array of output queues is  
11           shared by said plurality of output interfaces.

1            12. The switch fabric network of claim 11, wherein said multi-dimensional  
2            array of output queues comprise a three-dimensional array of output queues.

1            13. The switch fabric network of claim 11, said second switch element  
2            further comprising a plurality of virtual input queues, wherein each virtual input queue  
3            represents a portion of said buffer.

1            Sub 14  
2            The switch fabric network of claim 11, said second switch element  
3            further comprising an arbiter to select data for transmission of said data to a  
downstream switch element.

1           15. The switch fabric network of claim 14, wherein said arbiter selects said  
2           data by utilizing transmit pressure information.

1           16. A method of using a switch element in a switch fabric network, said  
2           method comprising:  
3            receiving data at an input interface of said switch element;  
4            routing said data to one of a multi-dimensional array of output queues provided  
5            within a buffer of said switch element; and  
6            outputting said data from a selected one of said output queues.

1           17. The method of claim 16, wherein said multi-dimensional array of output  
2           queues comprise a three-dimensional arrays of output queues.

1           Sub 18. The method of claim 17, wherein said three-dimensions comprise:  
2           a) a dimension relating to a number of outputs on said switch element;  
3           b) a dimension relating to a number of logical paths for said data; and  
4           c) a dimension relating to a number of outputs from a next switch element.

1           19. The method of claim 16, wherein said switch element comprises a  
2           plurality of virtual input queues, wherein each virtual input queue represents a portion  
3           of said buffer.

1           20. The method of claim 16, further comprising selecting said data in one of  
2            said output queues prior to said outputting.

1           21. The method of claim 20, wherein said data is selected based on status  
2            information at said switch element.

1           22. The method of claim 20, wherein said data is selected by utilizing  
2            transmit pressure information.

1           23. *Sub 15* The method of claim 16, further comprising transmitting a feedback  
2            signal from said switch element to a plurality of upstream switch elements, said  
3            feedback signal comprising status information of output queues of said switch element.

1           24. A switch element comprising:  
2            a buffer including a multi-dimensional array of output queues to store data; and  
3            an arbiter to select one of said output queues for transmission of data, and a  
4            queue status monitor to track the statuses of said multi-dimensional array of said  
5            output queues.

1 *Sub A* The switch element of claim 24, wherein said arbiter selects said one of  
2 said output queues based on information of said switch element and information of a  
3 next switch element.

1                   26. The switch element of claim 25, wherein said arbiter further selects said  
2                   one of said output queues based on transmit pressure information.

1                   27. The switch element of claim 24, wherein said multi-dimensional array of  
2                   output queues comprises three-dimensional output queues.

1 *Su A 28.* The switch element of claim 27, wherein said three-dimensions  
2 comprise:

3                   a)    a first dimension relating to a number of outputs on said switch  
4                   element;  
5                   b)    a second dimension relating to a number of logical paths; and  
6                   c)    a third dimension relating to a number of outputs from a next switch  
7                   element.

1                   29. The switch element of claim 24, further comprising a plurality of virtual  
2                   input queues, wherein each virtual input queue represents a portion of said buffer.

1       30.    The switch element of claim 24, wherein said arbiter selects said one of  
2        said output queues based on status information at said switch element.

1       Sub 31. The switch element of claim 24, wherein said queue status monitor  
2       transmits a feedback signal from said switch element to a plurality of upstream switch  
3       elements, said feedback signal comprising status information of output queues of said  
4       switch element.

1       32.    A method of communicating information in a switch element, said  
2       method comprising:  
3            receiving data at said switch element;  
4            storing said data in one queue of a multi-dimensional array of output queues in  
5       a buffer of said switch element; and  
6            selecting one of said output queues for transmission of data.

1       Sub 33. The method of claim 32, wherein selecting said one of said output  
2       queues comprises selecting based on information of said switch element and  
3       information of a next switch element.

1       34.    The method of claim 33, wherein said selecting is further based on  
2       transmit pressure information.

1                   35.     The method of claim 32, wherein said multi-dimensional array of output  
2     queues comprises a three-dimensional array of output queues.

Sub  
A 20.  
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The method of claim 35, wherein said three-dimensions comprise:

a) a first dimension relating to a number of outputs on said switch element;

and

- b) a second dimension relating to a number of logical paths for said data;
- c) a third dimension relating to a number of outputs from a next switch element.

37. The method of claim 32, wherein said switch element includes a plurality of virtual input queues, wherein each virtual input queue represents a portion of said buffer.

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*SUS 381 A* The method of claim 32, further comprising transmitting a feedback signal from said switch element to a plurality of upstream switch elements, said feedback signal comprising status information of output queues of said switch element.

39 A switch comprising:

- 2 a first output interface associated with a first output link;
- 3 a first queue associated with said first output interface; and

4 a first arbiter associated with said first output interface and said first queue,  
5 wherein said first arbiter schedules a next data packet for transmission from said first  
6 output interface based on one of a pressure function and a local path priority.

1 40. The switch of claim 39, wherein said first arbiter schedules said next data  
2 packet for transmission from said first output interface based on both said pressure  
3 function and said local path priority.

1 Sub 41. The switch of claim 40, wherein said first arbiter schedules said next data  
2 packet based on calculated transmit priorities of target queues in a downstream switch.

1 42. The switch of claim 41, wherein said first arbiter schedules said next data  
2 packet relating to a target queue having a highest calculated transmit priority.

1 43. The switch of claim 39, further comprising a second output interface  
2 associated with a second output link, a second output queue associated with said  
3 second output interface, and a second arbiter to schedule a next data packet for  
4 transmission from said second output interface.

1 Sub 44. The switch of claim 39, wherein said pressure function relates to a  
2 relationship of data in said switch and data in a downstream switch.

1           45. A method of scheduling data traffic from a switch, said method  
2           comprising:  
3               determining a transmit priority based on one of a pressure function and a local  
4           path priority; and  
5               scheduling data traffic based on said determined transmit priority.

1           46. The method of claim 45, wherein said determining is based on both said  
2           pressure function and said local path priority.

1           Sub P4   47. The method of claim 45, wherein transmit priority is further determined  
2           based on information of target queues in a downstream switch.

1           48. The method of claim 47, wherein said scheduling comprises selecting a  
2           target queue of said downstream switch having a highest calculated transmit priority.

1           49. The method of claim 45, wherein said pressure function relates to a  
2           relationship of data in said switch and data in a downstream switch.